

Lesson 6



Air pollution in Cairo

What Does It Cost?

In this final lesson, students return to the surfboard that began the unit. After defining the terms “input” and “output,” students draw on what they learned in previous lessons to identify the inputs and outputs associated with the production of a surfboard.

The class creates an input-output diagram, and discusses and analyzes what goes into the production of an object such as a surfboard (raw materials, energy, money) as well as what comes out of the manufacturing process (products, money, alterations in natural systems).

Students then create individual input-output diagrams that relate to

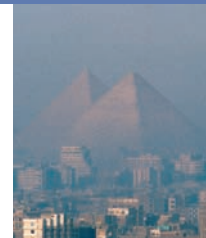
the toys they are designing in their **Manufacturing and Design Journals**. To complete this activity, students must revisit the source of the natural materials used in their toys; the extraction, harvesting, and transportation methods that accessing those resources requires; and the potential effects on natural systems associated with the manufacturing of their toys.



Polystyrene pollution

Learning Objective

Provide examples of how the methods used to extract, harvest and transport natural resources, and consume them (or make usable products) affect natural systems.



planet warm. These gases are known as greenhouse gases.

Over the past 100 years, the amount of carbon dioxide in the atmosphere has increased significantly. The National Oceanic and Atmospheric Administration (NOAA) links this rise to an increase in the burning of fossil fuels for industry, transportation, and other energy needs. Over this same period of time the average global temperature has risen approximately 1°F (0.56°C). Many human communities across the globe have started seeing some of the highest daily temperatures on record. These rising temperatures have also begun to affect Earth's natural systems. For example, glaciers have shrunk, average sea levels have risen, some insects' life cycles have accelerated (emerging earlier in the spring), and the permafrost (the frozen layer of ground) in the Arctic has begun to thaw. Although some debate remains over whether human activity is exacerbating the greenhouse effect and causing global climate change, it is clear that there are more greenhouse gasses in the atmosphere now than a century ago.

It is important for us to understand that our acquisition and use of natural resources may be having a significant effect on the future availability of those resources, let alone the planet's natural systems and the living things in them.

Background

The greenhouse effect is a natural process that makes life possible on Earth. The sun's energy enters Earth's atmosphere as shortwave, visible, ultraviolet energy. The gases in Earth's atmosphere either absorb this energy (ozone, for example), reflect it back out into space, or let it pass through to Earth's surface. Slightly less than half

of the incoming solar energy reaches Earth's surface, where it is absorbed by water, the land, and living things. Earth's own energy consists of some of this solar energy in combination with thermal energy from the planet's interior. Gases in the atmosphere, such as ozone, carbon dioxide, water vapor, methane, and carbon monoxide, trap some of this heat energy and keep the



Aerial spraying of wheat

Key Vocabulary

Inputs: Things such as material and money that go into the creation of something.

Outputs: Something produced or manufactured.

Toolbox



Summary of Activities

Students return to the surfboard from Lessons 1 and 2 and discuss the inputs and outputs associated with the production of that product. They create an input-output diagram for the toys they are designing in their **Manufacturing and Design Journals**.



Instructional Support

See Unit Resources, page 28

Prerequisite Knowledge



Students should have:

- completed previous lessons.

Advanced Preparation



Gather and prepare Activity Masters:

- Gather from previous lessons:
 - Student **Manufacturing and Design Journals** (individual student's copies)

Gather and prepare Materials Needed:

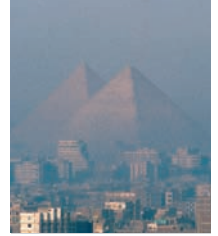
- Cut 16 14-inch arrows from the construction paper, eight tan and eight orange.
- Make a surfboard out of the white piece of construction paper. Decorate it if you wish.

Gather and prepare Visual Aids:

- Gather from previous lessons:
 - **Natural Resource Use Flowchart** from Lesson 1.

Prepare Diagram Pieces:

- Put at least two tape rings on the back of each arrow and the paper surfboard so that each can be mounted on the white board (or a wall) quickly during the lesson.



Materials Needed



A-V Equipment:

- Overhead projector or LCD projector, screen

Class supplies:

- Construction paper (white, pink, and yellow), tape, markers

Visual Aids



No Visual Aids are required for this lesson.

Duration



Preparation Time

20 min.

Instructional Time

60 min.



Safety Notes

None

Activity Masters in the Supporting Materials (SM)

No Activity Masters are required for this lesson.

Procedures

Step 1

Place the paper surfboard in the middle of a blank wall or in the middle of the white board. Ask students, “What product does this paper represent?” (*A surfboard*) Ask students to recall the making of a surfboard as described in **California Connections: A Surfboard Story** (Lesson 1 Activity Master), which they read in Lessons 1 and 2.

Step 2

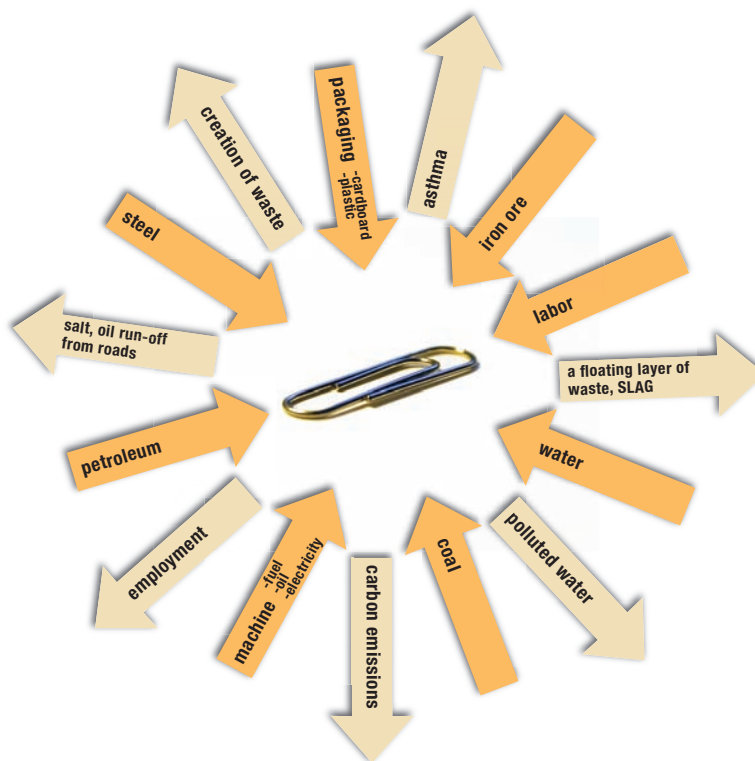
Write the terms “inputs” and “outputs” on the white board above the surfboard. Tell students that inputs are things that go into the creation of something and that outputs are things that come out of the creation of something. Explain to students that the surfboard is an output of all the steps and materials that went into making it.

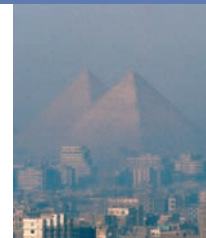
Ask students, “What inputs go into making a surfboard?” (*Energy to think up the design, money to get the resources needed, petroleum to make the foam, wood to form the stringer, bauxite and silica to make the aluminum or fiberglass, fuel to run the machines that extract and harvest the resources, fuel to transport the resources, energy to run the machines that are used to make the surfboard at the factory, fuel used by the trucks that carry the finished boards to the store.*)

As students name inputs, put the orange paper arrows on the white board, pointing toward the surfboard. Write a word or phrase describing an input on each arrow. Spread the orange arrows around the surfboard, leaving space to alternate with tan arrows.

Step 3

Have the class look at each of the input arrows and think of an output that comes from that input. (*A blueprint of the design, changes to the plants and animals in ecosystems, holes in the ground from drilling and mining, emissions from trucks and machines, etc.*) As students name the outputs, place a tan arrow pointing away from the surfboard next to the corresponding orange input arrow. The diagram should resemble this example:





Step 4

When students have run out of inputs and outputs, explain that when people buy something or use an object, they do not always see or think about the inputs and outputs involved in its creation. Ask students, “Why is it important to think about the inputs and outputs of the things we buy and use?” (*Knowing the inputs and outputs can help us choose between products that might be harmful to natural systems and human health and those that are not.*)

Step 5

Display the **Natural Resource Use Flowchart** (Visual Aid #1). Explain to students that no matter which part of the flowchart they look at, inputs and outputs go into and stem from each step. And all of those inputs and outputs affect the natural systems that provide the resources for each step of the chart.

Step 6

Distribute student **Manufacturing and Design Journals** (individual student’s copies). Have students turn to pages 21–22 (Inputs and Outputs) and review the instructions for completing the page. Leave the class input-output surfboard diagram on the white board so students can refer to it to as they complete the assignment. Give them the rest of the class period or homework time finish page 22 of their journals.

Step 7

Collect the completed journals for use in assessment.

Lesson Assessment

Description

This culminating lesson provides further examples of how the methods used to make common objects affect natural and human systems. After working as a class to identify inputs and outputs of the production of a surfboard, students complete the final page of their **Manufacturing and Design Journals** (individual student's copies) giving examples of the "inputs" and "outputs" related to the production of their toys.

Suggested Scoring

There is a maximum of 10 points for the diagrams students create on page 22 (Inputs and Outputs) of their **Manufacturing and Design Journal**. Use the following checklist to score each diagram.

- The diagram shows inputs as arrows pointing **toward** the name of the toy in the center circle. Each arrow has a logical input written on it. (1 point for each arrow.)
- The diagram shows outputs as arrows pointing **away** from the name of the toy in the center circle. Each arrow has a logical input written legibly on it. (1 point for each arrow.)
- The output arrows are situated in a way that indicates the student understands how each output relates to a specific input. (2 points total.)

An Answer Key with a sample diagram is provided on page 22 to help in assessment.

Answer Key and Sample Answers

Inputs and Outputs

Today's Task

Draw an input-output diagram like the one you just did with your class. You can use any of the pages in the journal to help you.

Think about:

Inputs

- natural resources
- raw materials
- energy
- money

Outputs

- changes to water, land, plants, or animals
- leftover materials, emissions

Write the name of your toy in the circle on the next page.

For each **input** you can think of for your toy, draw an arrow pointing *toward* the circle. On the arrow, write what the input is. Show as many inputs as you can.

Draw arrows pointing *away* from the circle for each **output** you can think of. On each arrow, write what the output is. Show as many outputs as you can.



Inputs and Outputs

